VAISALA

TECHNICAL REFERENCE

Upgrading from Vaisala Ultrasonic Wind Sensor WS425 to WMT700

M211097EN-C

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CHAPTER 1

GENERAL INFORMATION

This chapter provides general notes for the manual and WMT701, WMT702, and WMT703.

About This Manual

This manual contains instructions for upgrading to Vaisala WINDCAP® Ultrasonic Wind Sensor series WMT700 and using analog output and serial communication in a system configured for WS425.

Contents of This Manual

This manual consists of the following chapters:

- Chapter 1, General Information, provides general notes for the manual and WMT701, WMT702, and WMT703.
- Chapter 2, Introduction, provides general information on upgrading from WS425 to WMT700 wind sensor series.
- Chapter 3, Retrofit Installation, describes the retrofit installation procedure for WMT700.
- Chapter 4, Operating WMT700 in WS425 Analog Output Mode, provides information on operating WMT700 in analog output mode in a system configured for WS425.
- Chapter 5, Operating WMT700 with WS425 and SDI-12 , provides information for operating WMT700 in serial operation mode with WS425 or SDI-12 profiles.
- Chapter 6, Troubleshooting, describes common problems, their probable causes and remedies, and provides contact information for technical support.
- Appendix A, Complete Command Set for WMT700, lists all the commands available for WMT700.

Version Information

Table 1 Manual Revisions

Manual Code	Description
M211097EN-C	April 2011. This manual. Updated wiring instructions and added information on new ROSA analog cable.
M211097EN-B	September 2010. Previous manual. Updated mounting instructions and illustrations. Updated names of accessories and cables.
M211097EN-A	Previous version.

Related Manuals

Table 2 Related Manuals

Manual Code	Manual Name
M211095EN	Vaisala WINDCAP® Ultrasonic Wind Sensor Series WMT700 User's Guide

Documentation Conventions

Throughout the manual, important safety considerations are highlighted as follows:

WARNING Warning alerts you to a serious hazard. If you do not read and follow instructions very carefully at this point, there is a risk of injury or even death.

CAUTION Caution warns you of a potential hazard. If you do not read and follow instructions carefully at this point, the product could be damaged or important data could be lost.

NOTE Note highlights important information on using the product.

Safety

Vaisala WINDCAP® Ultrasonic Wind Sensor WMT701, WMT702, or WMT703 delivered to you has been tested for safety and approved as shipped from the factory. Note the following precautions:

WARNING	Make sure that you connect only de-energized wires.

WARNING	Using a long cable between different units (sensors, transmitters, power supplies, and displays) can cause a lethal surge voltage, if a lightning strike occurs in the vicinity. Always apply proper grounding procedures and follow the requirements of the local Electrical Code.

WARNING	To protect personnel (and the wind sensor), a lightning rod must be installed with the tip at least one meter above WMT700. The rod must be properly grounded, compliant with all local applicable safety regulations. Do not install the wind sensor above the top of the lightning protection rod.

WARNING	Do not install WMT700 when there is a risk of thunderstorm or lightning activity in the area.

CAUTION	When handling WMT700, do not rotate, pull, strike, bend, scrape or touch the transducers with sharp objects. Any impact on the wind sensor array damages the device.

Trademarks

Vaisala WINDCAP® is a registered trademark of Vaisala Oyj.

Windows® is a registered trademark of Microsoft Corporation in the United States and/or other countries.

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CHAPTER 2
INTRODUCTION

This chapter provides general information on upgrading from WS425 to WMT700 wind sensor series.

NOTE	In this manual, product types WMT701, WMT702 and WMT703 are commonly referred to as WMT700.

When upgrading to WMT700, you have the following installation options:

- Basic installation procedure, which consists of mounting WMT700 with the FIX70 mounting kit and the WMT700 mounting adapter.

  To upgrade to WMT700 according to this procedure, uninstall the WS425 wind sensor and mounting kit and follow the installation instructions in Vaisala WINDCAP® Ultrasonic Wind Sensor Series WMT700 User's Guide.

- Retrofit installation procedure, which consists of mounting WMT700 with a WS425 mounting kit and the WMT700 mounting adapter for FIX30/60.

  To upgrade to WMT700 according to this procedure, follow the instructions in Chapter 2, Retrofit Installation, on page 13 in this manual.

After WMT700 has been installed and configured, you can start operating the wind sensor as follows:

- To receive wind measurement data messages, use serial communication.

  When using the WMT700 or MES12 profile, see the operating instructions in Vaisala WINDCAP® Ultrasonic Wind Sensor Series WMT700 User's Guide.

  When using the WS425 or SDI-12 profiles, see the operating instructions in Chapter 5, Operating WMT700 with WS425 and SDI-12 , on page 41 in this manual.

- To receive wind measurement data as current, potentiometer, voltage, or frequency output, use analog output.

  For general information, see Vaisala WINDCAP® Ultrasonic Wind Sensor Series WMT700 User's Guide.

  For instructions for systems configured for WS425, see Chapter 4, Operating WMT700 in WS425 Analog Output Mode, on page 33 in this manual.

CHAPTER 3

RETROFIT INSTALLATION

This chapter describes the retrofit installation procedure for WMT700.

Retrofit Installation Procedure

At the measurement site, WMT700 needs to be mounted and connected to the power source and data acquisition system.

After upgrading to WMT700, it is possible to install the optional bird prevention kit available for the wind sensor. For more information, see Vaisala WINDCAP® Ultrasonic Wind Sensor Series WMT700 User's Guide.

WARNING To protect personnel (and the wind sensor), a lightning rod must be installed with the tip at least one meter above WMT700. The rod must be properly grounded, compliant with all local applicable safety regulations. Do not install the wind sensor above the top of the lightning protection rod.

WARNING Do not install WMT700 when there is a risk of thunderstorm or lightning activity in the area.

CAUTION When handling WMT700, do not rotate, pull, strike, bend, scrape or touch the transducers with sharp objects. Any impact on the wind sensor array damages the device.

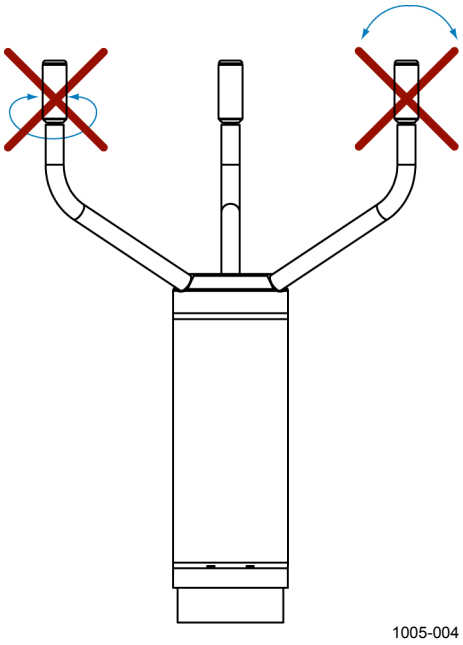


Figure 1 WMT700 Sensor Handling

Unpacking Instructions

WMT700 is shipped in a cardboard custom container with plastic transportation dampers. One of the dampers protects the wind sensor body, while the other shields the array and the transducers. See Figure 2 on page 15.

When unpacking the wind sensor, remove the transportation damper that protects the sensor body. To avoid bending or twisting the array, do not remove the damper protecting the array until you have installed WMT700.

Figure 2 below shows the damper protecting the array.

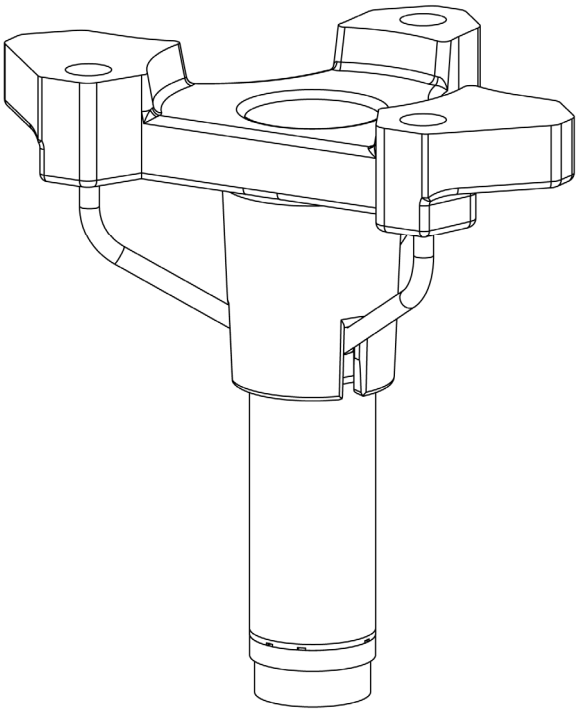


Figure 2 WMT700 and Transportation Damper

NOTE	Save the container and all the packaging materials for future transporting or shipping.

Mounting

You can mount WMT700 either to a vertical pole mast or a horizontal cross arm using a WS425 mounting kit. The procedure for both mounting options is identical. Typically you can upgrade from WS425 to WMT700 without removing the mounting kit.

NOTE

If you remove the mounting kit, you need to align the wind sensor after the mounting procedure. To facilitate the aligning process, mark both the wind sensor and the mounting kit with a marker pen before removing the mounting kit.

You can use the mark as a rough reference when starting the aligning process described in Chapter 4, Installation, section Alignment, in the Vaisala WINDCAP® Ultrasonic Wind Sensor Series WMT700 User's Guide.

When mounting WMT700 to a cross arm, the wind sensor can be placed with the array facing up or down. If the wind sensor is installed with the array facing down, you must configure WMT700 accordingly. For configuration instructions, see Vaisala WINDCAP® Ultrasonic Wind Sensor Series WMT700 User's Guide.

Figure 3 on page 17 shows the mounting procedure to a vertical pole mast. Figure 4 on page 18 and Figure 5 on page 19 show the mounting procedure to a horizontal cross arm.

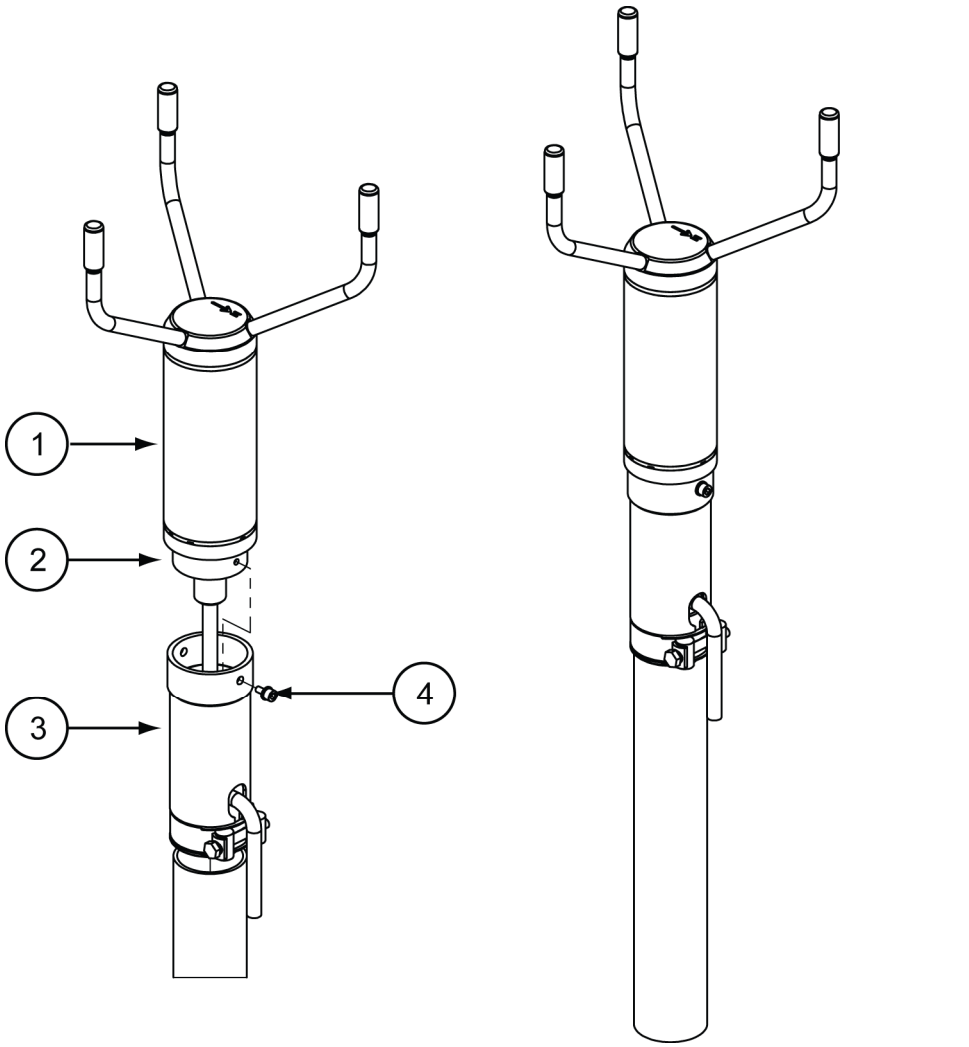


Figure 3 WMT700 Retrofit Installation to Pole Mast

The following numbers refer to Figure 3 above:
1 = WMT700 wind sensor
2 = Mounting adapter for FIX30/60
3 = WS425 mounting kit
4 = Mounting screw

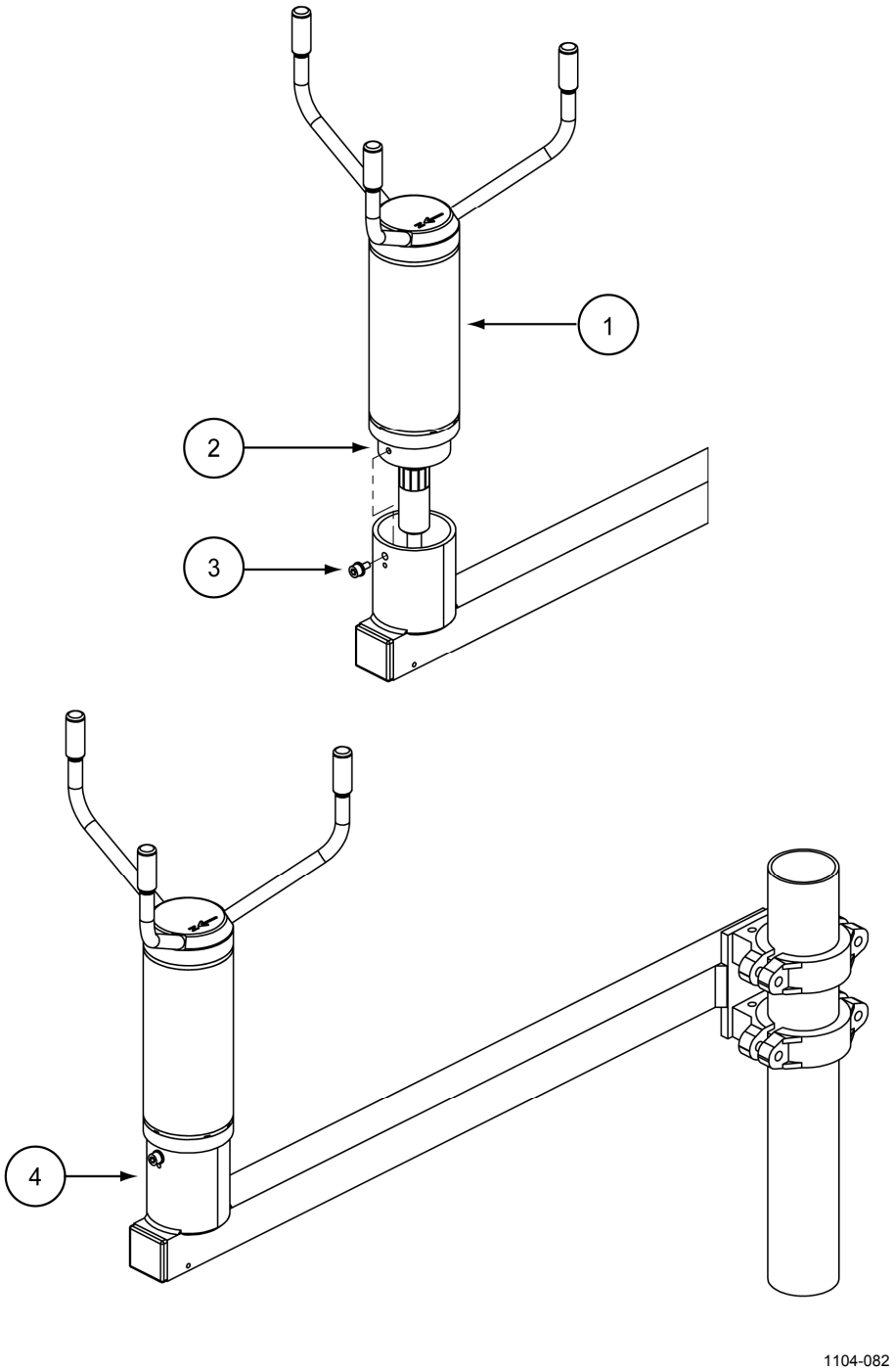


Figure 4 WMT700 Retrofit Installation to Cross Arm with Array Facing Up

The following numbers refer to Figure 4 above:

1 = WMT700 wind sensor
2 = Mounting adapter for FIX30/60
3 = Mounting screw
4 = WS425 cross arm

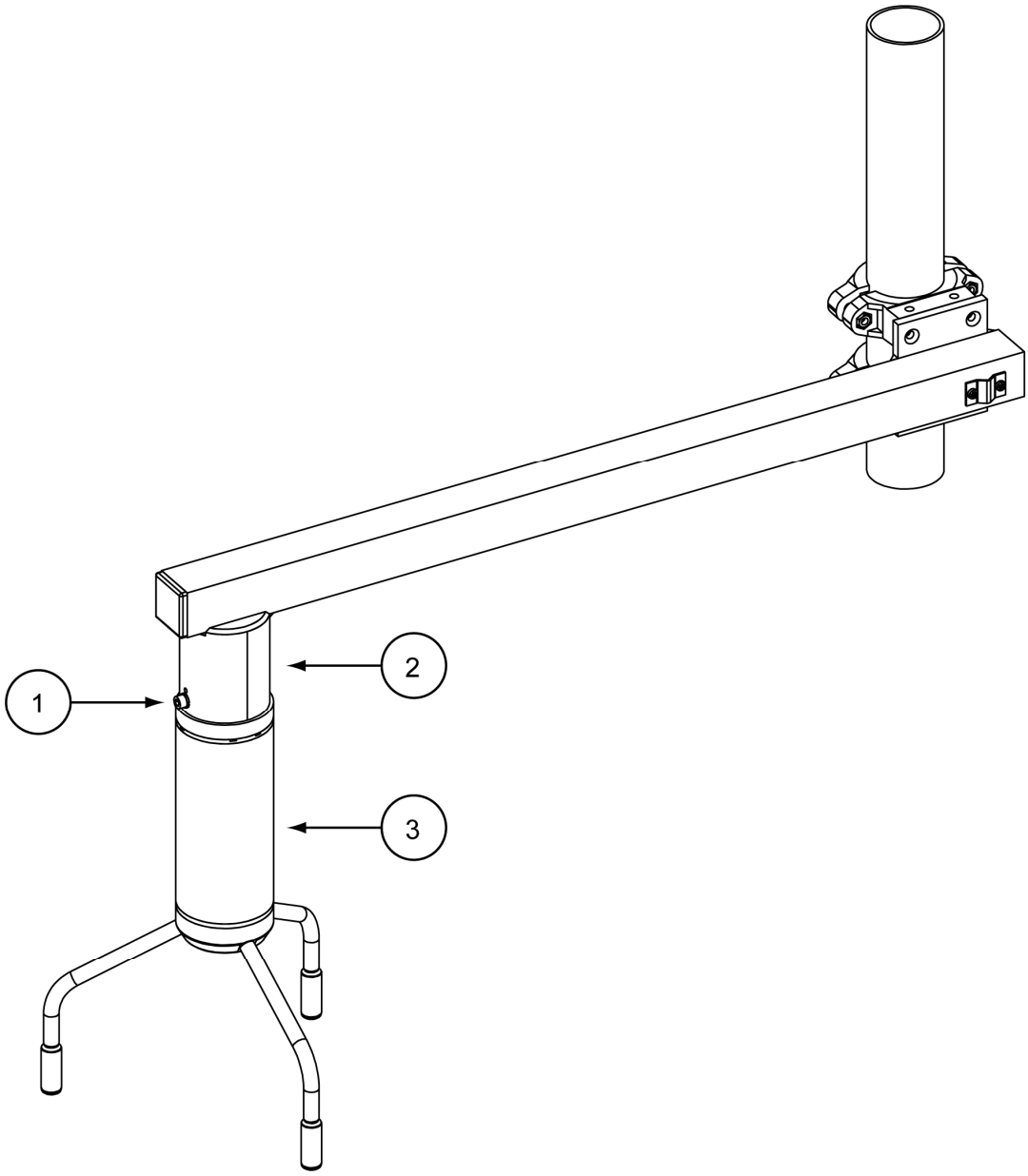


Figure 5 WMT700 Retrofit Installation to Cross Arm with Array Facing Down

The following numbers refer to Figure 5 above:
1 = Mounting adapter for FIX30/60
2 = WS425 cross arm
3 = WMT700 wind sensor

Before You Start

Before you start the retrofit installation procedure, make sure that you have the correct items:

- Correct mounting kit (already attached to the mast) for retrofit installation. Figure 6 below shows the available options: FIX30 and FIX60.

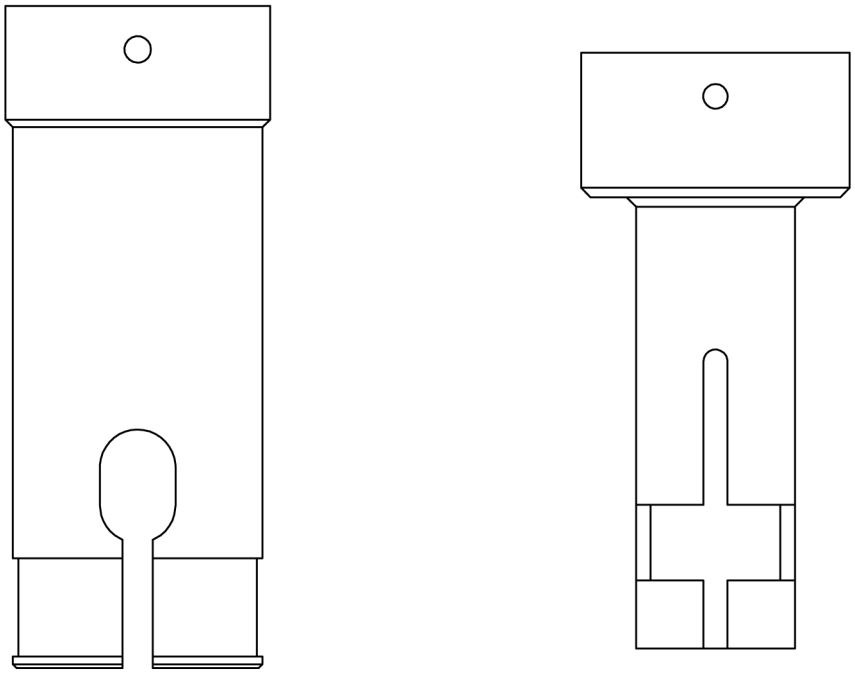


Figure 6 FIX60 (Left) and FIX30 (Right)

For information on the FIX70 mounting kit, see Vaisala WINDCAP® Ultrasonic Wind Sensor Series WMT700 User's Guide.

- Correct mounting adapter for your installation; FIX30 or FIX60, see Figure 7 below. The diameter of the mounting adapter for FIX30/60 adapter is 61 mm. Change the mounting adapter if necessary. If you are not sure that you have the correct mounting adapter, contact Vaisala.

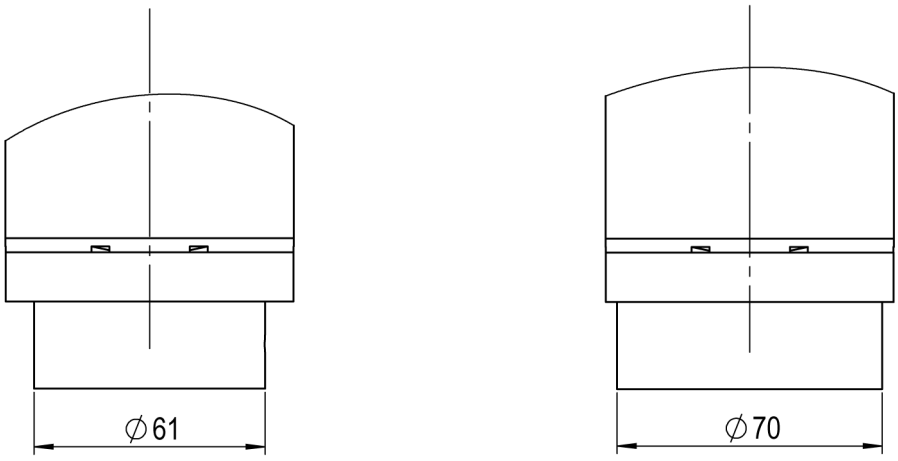


Figure 7 Mounting Adapter for FIX30/60 (Left) and Mounting Adapter (Right)

- Correct cables for the mounting kit and analog output/serial communication. Table 3 on page 22 lists the available cables for retrofit installation. The In/Out stands for the possibility to route the cable either inside of outside of the mast.

NOTE	If you have FIX30, do not use the adapter cables but order the appropriate WMT700 cable. The adapter cable will not fit inside the mast.

Table 3 Mounting Kits and Cable Codes

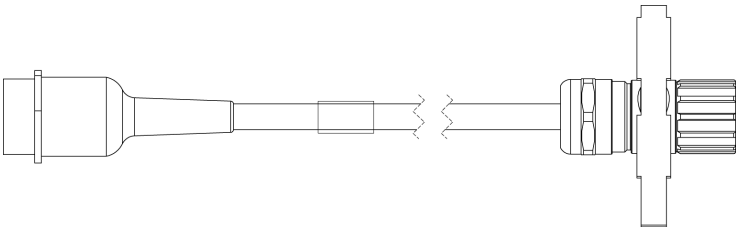
Description	Spare Part Item	FIX70		FIX30		FIX60	
		In	Out	In	Out	In	Out
WMT700 Cables with open leads one end (Standard 2m/10m, RS485 2m/10m, ROSA analog 10m)	227567SP	x	x	x		x	x
	227568SP	x	x	x		x	x
	231425SP	x	x	x		x	x
	228259SP	x	x	x		x	x
	228260SP	x	x	x		x	x
WMT700 Cables with connectors on both ends (MAWS, AWS520):	227565SP	x	x	x	x	x	x
	229807SP	x	x	x		x	x
	227566SP	x	x	x		x	x

Mounting Procedure

To upgrade from WS425 to WMT700:

1. Uninstall the WS425 wind sensor.
2. If you are using a WMT700 cable, run the cable through the WS425 mounting kit. Connect the cable to the WMT700 wind sensor.

   If you are using a WS425 cable, ensure the pre-installed o-ring seal sits properly in the plastic male connector (between the existing WS425 cable and the adapter cable). Connect the WS425 cable to the WS425 adapter cable (see Figure 8 below). Run the adapter cable through the WS425 mounting kit. Connect the cable to the WMT700 wind sensor.



1103-012

Figure 8 WS425 Adapter Cable

3. Tighten the connector by rotating the connector by hand clockwise, see Figure 9 on page 23.

   Ensure that the connector is properly tightened before proceeding to the next step. If you are unable to tighten the connector, loosen the mounting adapter fixing screws, remove the mounting adapter, and connect the cable. After that, reattach the mounting adapter.

4. Attach the WMT700 sensor body to the WS425 mounting kit and tighten the bolt.
5. Remove the transportation damper protecting the array and store it for future use.
6. Connect the cable to the data acquisition system and power supply. Connect the wires according to section Wiring on page 25.

WMT700 is now ready for operation.

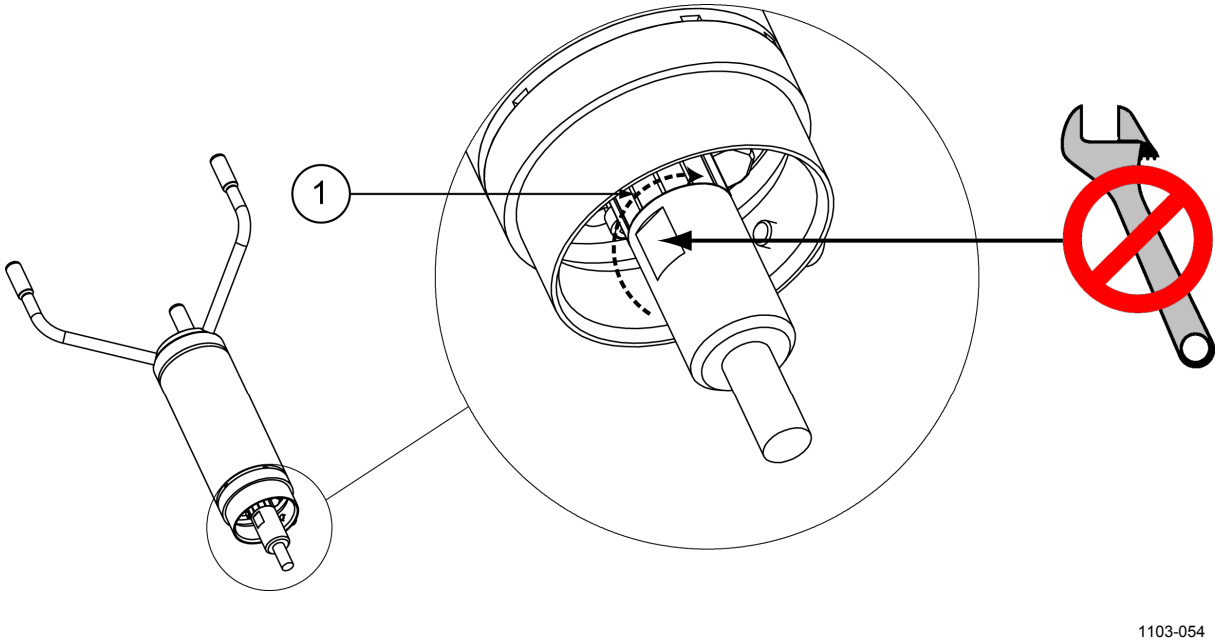


Figure 9 Tightening the Connector

The following number refers to Figure 9 above:

1 = Tighten the connector by rotating the ribbed part of the connector by hand. DO NOT USE TOOLS.

NOTE	Verify that the connector is properly tightened to avoid water leakage and damage to the sensor. If water leaks into the connector, this voids the warranty for WMT700.

Check List for Connection Cables

Take the following issues into account when installing WMT700:

- Routing of the cables depends on the mounting option selected for WMT700. When mounting to a mast, the cable can be routed either outside or inside the mast depending on the mast type and other equipment (for instance, lightning rods) installed to the mast.
- Make sure that the cable is properly attached to the mast or cross arm before starting the installation. Otherwise it may slip and fall down during the installation procedure.
- It is important to attach the cable properly to avoid strain on the connector. Too much strain may cause the cable to fall off, damage the cable or connector, or make the cable or connector susceptible to leakage. The recommended minimum bending radius for the cable is 70 mm.

WARNING Make sure that you connect only de-energized wires.

WARNING Using a long cable between different units (sensors, transmitters, power supplies, and displays) can cause a lethal surge voltage, if a lightning strike occurs in the vicinity. Always apply proper grounding procedures and follow the requirements of the local Electrical Code.

WARNING Do not install WMT700 when there is a risk of thunderstorm or lightning activity in the area.

Wiring

There are two ways of performing the WMT700 retrofit installation:

- Using Standard WMT700 Cables
- Using WS425 Cables with adapters

When performing WMT700 retrofit installation, the possible cables depend on the selected mounting kit. For the FIX60 mounting kit, adapter cables are provided for the WS425 serial and analog output modes.

For instructions on connecting WMT700 to the host device for other operation modes or using the WMT700 cable, see Vaisala WINDCAP® Ultrasonic Wind Sensor Series WMT700 User's Guide.

NOTE	To avoid unnecessary connectors and maximize long-term reliability, Vaisala recommends that you use the WMT700 cable for the retrofit installation.

Using Standard WMT700 Cables

This is the recommended way for the retrofit installation. There are various cables available for the installation:

- Cable 2m (Spare part Item: 227567SP)
- Cable 10m (227568SP)
- RS485 Cable 2m (228259SP)
- RS485 Cable 10m (228260SP)
- ROSA Cable 10m for Analog Outputs (231425SP)
- MAWS Cable 10m (227565SP)
- AWS520 Cable 10m, Shield connected to PE pin (229807SP)
- AWS520 Cable 10m, Shield not connected to PE pin (227566SP)

ROSA Cable 10m (Analog Outputs)

The ROSA Cable 10m (231425SP) is intended for replacing WS425 with WMT700 in Vaisala ROSA system in case the WS425 has been connected using analog outputs. Table 4 on page 26 shows the wire colors and related signals on WMT700.

Note that there are serial port signals available for configuration purposes on the cable even though they are not used as operational. The unused

wires must be properly isolated and terminated to avoid unwanted operation or failure.

Table 4 ROSA Cable 10m (231425SP)

Power Supply			**Wire Colors**	**Pin**
Operating Power Supply			White	1
Operating Power Supply Ground			Gray-Pink	11
Heater Power Supply			Gray	5
Heater Power Supply			Pink	6
Heater Power Supply Ground			Blue	7
Heater Power Supply Ground			Red	8
Enclosure Ground			Shield	Shield
Analog Outputs				
Analog Output AOUT2, Wind Direction			Brown	2
Analog Output AOUT1, Wind Speed			White-Green	13
Reference Input for AOUT2 (simulated potentiometer)			White-Gray	17
Analog Output Ground			Red-Blue	12
COM port	**RS-232**	**RS-485**		
COM2	RS232Rx	RxB	Green	3
	RS232Tx	TxB	Yellow	4
	-	TxA	Brown-Green	14
	-	RxA	White-Yellow	15
COM1 and COM2 Communication Ports Ground			Violet	10
COM1 (service port)	RS-485, B		Black	9
	RS-485, A		Brown-Yellow	16

Other WMT700 Standard Cables

For instructions on connecting WMT700 to the host device for other operation modes or using the WMT700 cable, see Vaisala WINDCAP® Ultrasonic Wind Sensor Series WMT700 User's Guide.

Using WS425 Cables with adapters

If retrofit installation using WMT700 cables is not possible, there are adapters available for most of the situations.

- Adapter Cable for WS425 Serial (227569SP)
- Adapter Cable for WS425 Analog Frequency Output (227570SP)
- Adapter Cable for WS425 Analog Voltage Output (227571SP)

The adapter cable specifications in this section apply for both heated and non-heated versions of WMT700.

NOTE FIX30 is not compatible with adapter cables due to the small diameter of the mast.

Adapter Cable for WS425 Serial Output

The Adapter Cable for WS425 Serial (227569SP) can be used with the WS425 cables ZZ45203 and 010411.

Table 5 below lists the adapter pin-outs and signal descriptions as they appear on their user guides for both WMT700 and WS425 connectors.

Table 5 Pin-Outs for WS425 Serial Adapter Cable (227569SP)

WMT700 Connector Pin	WMT700 Signal Description	WS425 Connector Pin	WS425 Signal Description	WS425 Wire Color
1	Operating Power Supply	11	+12 VDC	Brown
3	**COM2:** RxB / RS232RX	10	Data in (RxD) (R-) (RT-)	Blue
4	**COM2:** TxB / RS232TX	9	Data out (TxD) (T-) (RT-)	Red
5	Heater Power Supply	16	+36 VDC	Grey/Pink
7	Heater Power Supply Ground	3	GND	Green
10	**COM2:** Communications Ground	8	GND	Yellow
11	Operating Power Supply Ground	1	GND	Black
14	**COM2:** TxA	12	Data out (T+) (RT+)	White
15	**COM2:** RxA	14	Data in (R+) (RT+)	Pink

NOTE The Adapter Cable for WS425 Serial (227569SP) does not support SDI-12 operation.

Adapter Cable for WS425 Analog Frequency Output

The Adapter Cable for WS425 Analog Frequency Output (227570SP) can be with the WS425 cable ZZ45204. Table 6 on page 28 lists the adapter pin-outs and signal descriptions as they appear on their user guides for both WMT700 and WS425 connectors.

Table 6 Pin-Outs for WS425 Analog Frequency Output Adapter Cable

WMT700 Connector Pin	WMT700 Signal Description	WS425 Connector Pin	WS425 Signal Description	WS425 Wire Color
1	Operating Power Supply	11	+12 VDC	Brown
2	Analog Output AOUT2, Wind Direction	13	WD Vout	Grey
5	Heater Power Supply	16	+36 VDC	Grey/Pink
7	Heater Power Supply Ground	3	GND	Green
11	Operating Power Supply Ground	1	GND	Black
12	Analog Output Ground	8	GND	Yellow
13	Analog Output AOUT1, Wind Speed	14	WS Fout	Pink
17	Reference Input for AOUT2	12	WD Vref in	White

Adapter Cable for WS425 Analog Voltage Output

The Adapter Cable for WS425 Analog Voltage Output (227571SP) can be used with the WS425 cable ZZ45204. Table 7 on page 29 lists the adapter pin-outs and signal descriptions as they appear on their user guides for both WMT700 and WS425 connectors.

Table 7 Pin-Outs for WS425 Analog Voltage Output Adapter Cable

WMT700 Connector Pin	WMT700 Signal Description	WS425 Connector Pin	WS425 Signal Description	WS425 Wire Color
1	Operating Power Supply	11	+12 VDC	Brown
2	Analog Output AOUT2, Wind Direction	13	WD Vout	Grey
5	Heater Power Supply	16	+36 VDC	Grey/Pink
7	Heater Power Supply Ground	3	GND	Green
11	Operating Power Supply Ground	1	GND	Black
12	Analog Output Ground	8	GND	Yellow
13	Analog Output AOUT1, Wind Speed	15	WS Vout	Violet
17	Reference Input for AOUT2	12	WD Vref in	White

Differences between WMT700 and WS425 Analog Output Signals

WMT700 pin connections differ from the connections of WS425 in that wind speed signal output, both voltage and frequency signals, appears on WMT700 pin 13.

NOTE WMT700 analog outputs must be configured according to the appropriate analog output mode, which is either voltage, frequency, or potentiometer.

Table 8 on page 30 lists the analog output connections for WMT700 and WS425 connector pins.

Table 8 Analog Output Connections

WMT700 Connector Pin	WMT700 Signal Description	Voltage Output	WS425 Connector Pin, Wire Color
13	Analog Output AOUT1, Wind Speed	Voltage	15: Violet (connect pin 14 to ground)
		Current	not available
		Frequency	14, Pink
2	Analog Output AOUT2, Wind Direction	Voltage	13, Grey
		Current	not available
		Potentiometer	13, Grey
17	Reference Input for AOUT2	Potentiometer	12, White
12	Analog Output Ground	All modes	1, Black (common with supply ground)

Powering

WMT700 is designed to operate with the same supply voltages as WS425 and no connection changes are necessary. The power consumption depends on the selected heating options. WMT700 with Heated Transducers can be used to replace similar WS425 models. When upgrading from WS425 to WMT700 with Heated Transducers and Arms, more capacity is required from the power supply unit.

For information on power supply requirements of each WMT700 product type, see Table 9 below.

For more information on powering, see Vaisala WINDCAP® Ultrasonic Wind Sensor Series WMT700 User's Guide.

Table 9 Heating Power Supply Requirements for WMT700 Series

Heating Option	Heating Voltage	Required Heating Power Supply
None	-	-
Transducers	24/36 VDC	40 W
Transducers and arms	24 VDC	200 W

NOTE

When WMT700 is in operation, the power consumption is higher than with WS425. This can affect system performance in power-critical applications such as solar-powered or battery-powered systems.

Use solar-powered or battery backup only to secure operating voltage. Ensure that the solar-powered system has a sufficient power reserve available.

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CHAPTER 4

OPERATING WMT700 IN WS425 ANALOG OUTPUT MODE

This chapter provides information on operating WMT700 in analog output mode in a system configured for WS425.

NOTE	For general information on operating WMT700 with analog output, see Vaisala WINDCAP® Ultrasonic Wind Sensor Series WMT700 User's Guide.

Analog Output Settings

In analog output operation WMT700 takes measurements according to the configured averaging time and synthesizes the analog outputs of wind speed and wind direction with an update interval of 0.25 seconds. The analog output signal type and range depend on the configured settings, see Vaisala WINDCAP® Ultrasonic Wind Sensor Series WMT700 User's Guide.

Normally analog output is enabled and the output settings are preconfigured at the factory according to the customer order. You can start using WMT700 directly after the installation with these settings. However, you can change the analog output settings of WMT700 at any time or disable the analog output functionality to save power over the serial interface.

When operating WMT700 in a system configured for WS425, the analog output settings must be configured according to Table 10 on page 34 using the **S** command. For more information on the **S** command, see S Set Parameter in Vaisala WINDCAP® Ultrasonic Wind Sensor Series WMT700 User's Guide.

Table 10 Required Parameters for WS425 Analog Output Operation Mode

Parameter Name	Default Value	Allowed Values	Description
aoErrValue	1000	0 …. 32000	Set 2 for voltage output and 1000 for frequency output for similar operation as with WS425.
aout1_g	1	0 …. 100	Gain for AOUT1. Set 0.01789 for compatibility with WS425 voltage output. Set 11.18 for compatibility with WS425 frequency output.
aout2_g	1	0 …. 100	Gain for AOUT2. Set 0.0027 for compatibility with WS425 potentiometer output.
aout1mode	3	(0 = current) 1 = voltage 2 = frequency (3 = disabled)	Analog output mode for AOUT1. Set 1 for voltage and 2 for frequency.
aout2mode	7	(4 = current) (5 = voltage) 6 = potentiometer (7 = disabled)	Analog output mode for AOUT2. Set 6 for potentiometer.
aout1_o aout2_o	0	-10000 … 10000	Offset for AOUT1 and AOUT2. Set output offset to 0.

For configuration instructions, see Vaisala WINDCAP® Ultrasonic Wind Sensor Series WMT700 User's Guide.

Wind Speed Output

In a system configured for WS425, you can set WMT700 to measure wind speed and send analog output as frequency or voltage.

The sections below describe WMT700 analog output when:

- Settings are configured according to Table 10 on page 34.
- Wires are connected according to section ROSA Cable 10m (Analog Outputs) on page 25.

Frequency

When frequency is selected as the wind speed analog output, WMT700 sends a pulsed signal of 0 to 10 V with a frequency proportional to wind speed through AOUT1. Every mile per hour adds 5 Hz (WS425) or every meter per second adds 10Hz (WMT700) to the frequency. In SI units, a change of 0.894 meters per second adds 10 Hz to the frequency. A frequency counter is required to count the output in Hz and the calculation that scales the result to appropriate units.

Figure 10 on page 36 shows the frequency output when an adapter cable for analog frequency output and a WS425 cable are used. With WMT700, the wind speed signal appears at pin 13.

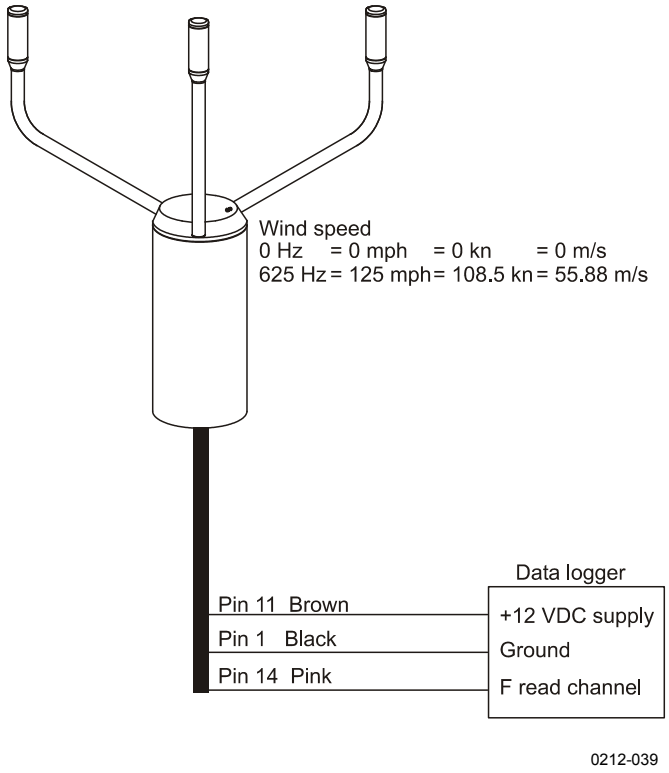

Figure 10 Wind Speed Frequency Analog Output with WS425 Cable and Adapter Cable for Analog Frequency Output

Voltage

When voltage is selected as the wind speed analog output, the output from WMT700 varies linearly from 0 VDC at 0 miles per hour to 1 VDC at 125 miles per hour or 100 mV/m/s. In SI units, the voltage varies linearly from 0 VDC at 0 meters per second to 1 VDC at 55.88 meters per second.

Figure 11 on page 37 shows the voltage output when an adapter cable for voltage output and a WS425 cable are used. With WMT700, the wind speed signal appears at pin 14 (pink). The pink wire must be connected to V read channel, and the violet wire must be connected to the ground.

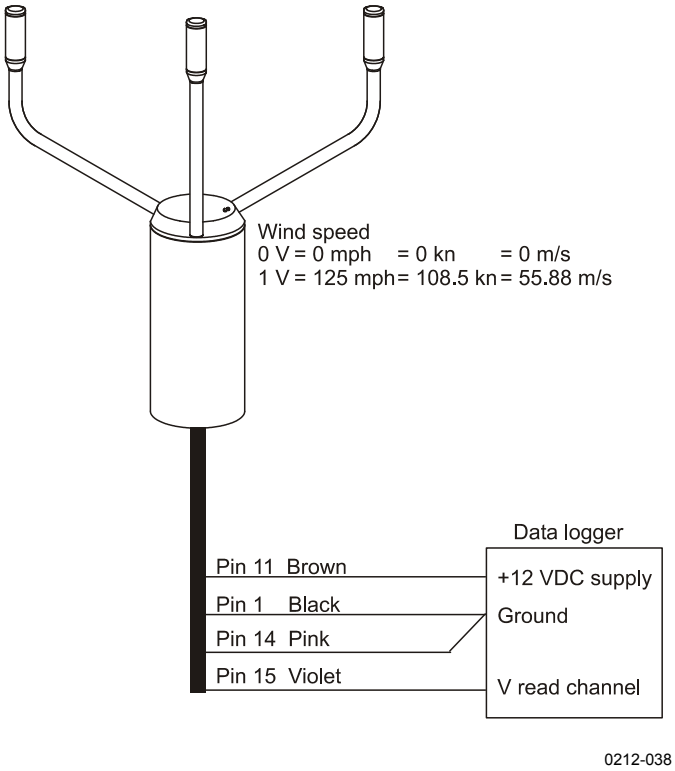

Figure 11 Wind Speed Voltage Analog Output with WS425 Cable and Adapter Cable for Analog Voltage Output

Wind Direction Output

When wind direction is measured, WMT700 sends analog output as simulated potentiometer output voltage referred to as external reference voltage. The output is a proportional signal 0 ... 100 % of the reference voltage representing the wind direction. The reference voltage must be in the range of 1.0 to 4.0 VDC (WMS425) or 0…10 VDC (WMT700). The output is 0 VDC at zero degrees and increases to the reference voltage at 359 degrees.

Figure 12 on page 38 shows the output for wind direction. With WMT700, the wind direction signal appears at pin 13 (gray), similarly to the WS425 wind sensor.

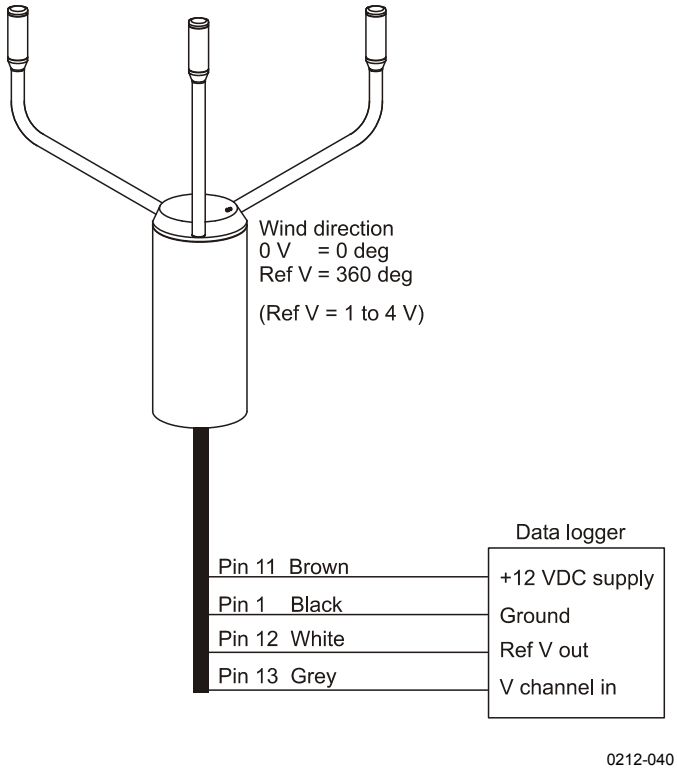

Figure 12 Wind Direction Voltage Output with WS425 Cable and Adapter Cable

Limitations for Output Signals

You can specify the minimum and maximum values for analog output with the configuration parameters. The output is fixed to the specified values, and the unit depends on the selected analog output mode.

Example

To limit the output 1 in voltage mode to a range of 0.1 … 5 V, set the analog output minimum value to 0.1 and the analog output maximum value to 5. Enter the following commands:

```
S aout1minv,0.1
S aout1maxv,5
```

For information on the parameters, refer to Vaisala WINDCAP® Ultrasonic Wind Sensor Series WMT700 User's Guide.

Missing Readings and Error Indication

If WMT700 is not able to measure the wind, it indicates a missing reading in the output. Most common reasons for measurement problems are foreign objects (such as ice, birds, or other foreign object) on the line of measurement or sound reflections from nearby objects (such as wind tunnel walls).

The default error indication is an out-of-range signal that is more than 10 V or 20 mA but other error settings can also be configured. You can also disable error indication if necessary.

For more details, see Vaisala WINDCAP® Ultrasonic Wind Sensor Series WMT700 User's Guide.

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CHAPTER 5

OPERATING WMT700 WITH WS425 AND SDI-12 PROFILES

This chapter provides information for operating WMT700 in serial operation mode with WS425 or SDI-12 profiles.

In this chapter each communication profile has its own section listing the configurable parameters and the available commands and data messages. For information on available commands and data messages when using the WMT700 profile, see Vaisala WINDCAP® Ultrasonic Wind Sensor Series WMT700 User's Guide.

NOTE	For a complete list of the serial commands available for WMT700, refer to Appendix A, Complete Command Set for WMT700, on page 75.

Communication Profiles

In addition to the WMT700 and MES12 profiles, WMT700 supports the following communication profiles:

- WMT700
- ROSA - MES12
- WS425 - ASCII
- WS425 - NMEA Extended (version 0183)
- WS425 - SDI-12 (version 1.3)
- WS425 - ASOS

The profile has been preconfigured at the factory according to the requirements specified when ordering WMT700. You can change the profile through the serial interface, if necessary. For instructions, see Vaisala WINDCAP® Ultrasonic Wind Sensor Series WMT700 User's Guide.

Getting Started

The communication profile and other settings have been configured at the factory according to the customer specifications given when ordering the product. You can start using WMT700 directly after the installation with these settings.

In case you want to change the communication profile, you must also check the other required parameters and change them if necessary. The selected profile does not automatically change the settings. The configurable parameters are listed separately for each profile in this manual.

Operating WMT700 with Terminal Program

To operate WMT700 through a serial connection, the following prerequisites are needed:

- PC with a serial port.
- Required cables for serial connection. For more information, see section Before You Start on page 20.
- Any terminal program, such as Tera Term or Windows® HyperTerminal.

To switch on WMT700 in measurement mode using Windows® HyperTerminal:

1. Connect a cable between your terminal computer, power supply and WMT700.
2. Open the Windows® HyperTerminal program.
3. Cancel the new connection.
4. From the **File** menu, click **Properties**.
5. Select the correct COM port and click **Configure**.
6. Set the communication parameters according to the configured port settings of WMT700.

   The default values for WMT700 are:

   - **Bits per second: 9600**
   - **Data bits: 8**
   - **Parity: None**
   - **Stop bits: 1**
   - **Flow control: None**

For the correct settings for SDI-12 profile, see section SDI-12 on page 60.

7. Click **Apply** and **OK**.
8. On the **Settings** tab, click **ASCII setup**. Select **ASCII sending - Send line ends with line feed** (optional). Click **OK** and close the **New Connection Properties** window.
9. On the **View** menu, click **Font**. In the **Font** list, select **Terminal**.
10. From the **Call** menu, click **Call**. Enter a name and select an icon for the connection. Click **OK**.
11. Switch the sensor power supply on.

    The following information is displayed:

    ```
    wmt700 v.<version number>
    ```

12. Wait for 4 seconds. WMT700 enters measurement mode automatically.
13. To test the connection, enter configuration mode with the following command.

    ```
    $0OPEN<CR><LF>
    ```

14. Use the following command to return to measurement mode:

    ```
    CLOSE<CR><LF>
    ```

    You can now start operating WMT700. However, WMT700 does not send data messages automatically unless configured to do so.

    For information on operating commands and data messages, see the profile-specific section in Vaisala WINDCAP® Ultrasonic Wind Sensor Series WMT700 User's Guide.

NOTE	In configuration mode, you can use any of the following end-of-line character combinations: <CR><LF>, <CR>, or <LF>.

Entering Configuration Mode

This command switches the serial port to configuration mode. The command works with any communication profile supported by WMT700.

```
$aOPEN<CR><LF>
```

where

$	=	Fixed text.
a	=	Value of the **address** parameter. If the value is 0, it refers to any WMT700 address.
<CR>	=	Carriage return.
<LF>	=	Line feed.

WS425 F/G ASOS Profile

Configurable Parameters

Table 11 on page 45 lists the configurable parameters and their allowed and default values for the WS425 F/G ASOS profile.

Table 11 Configurable Parameters for WS425 F/G ASOS Profile

Parameter	Default Value	Profile-specific Allowed Values	Description
autoSend	0	0 = automatic messages disabled	Automatic data message number. Selects the data message format for automatic messages.
com1_protocol com2_protocol (depending on the port used for operating WMT700)	0	2 = WS425 F/G ASOS	Profile for serial ports COM1 and COM2.
wndAvg	1	0.25 … 3600 Resolution: 0.25	Averaging time for wind measurement in seconds.
wndGustTime	3	0.25 … 3600 Resolution: 0.25	Averaging time for wind minimum and maximum in seconds.
wndOrientation	0	0 = array facing up 1 = array facing down	Orientation of the array of WMT700.
wndUnit	0	0 = meters per second (m/s) 1 = miles per hour (mph) 2 = kilometers per hour (km/h) 3 = knots (knot)	Wind speed unit.
wndVector	1	0 = scalar averaging	Wind averaging method.

To start continuous measurement, use the **START** command. You can stop the measurement with the **STOP** command. For instructions, refer to Vaisala WINDCAP® Ultrasonic Wind Sensor Series WMT700 User's Guide.

WS425 F/G ASOS Commands

WMT700 responds to each command with a fixed-length message. In each of the command descriptions below, <CR> is an ASCII carriage return control character and <LF> is an ASCII line feed control character.

NOTE When the WS425 F/G ASOS profile is selected, WMT700 only responds to upper case characters.

Table 12 below lists the available commands for operating WMT700 with the WS425 F/G ASOS profile.

Table 12 List of WS425 F/G ASOS Commands

Command	Description
WA	Requests average wind speed and direction message.
WS	Requests the verbose Built-In Test (BIT) results.

The **WA** command is executed by the ASOS at an interval that ranges from 1 to 30 seconds. For the **WA** command, WMT700 responds to the ASOS interrogation poll within 250 milliseconds of receiving the request.

NOTE

The following WS425 F/G ASOS commands cannot be used with WMT700: **WB**, **WFIRMWARE**, **WJ**, **WD**, **WF**, **WR**, **WCAL**, **WH**, **WT**, **WCDV**, **WSTK**, **WL, WM, WN, WSST**, and **WATE**.

WMT700 can only be configured in the configuration mode. For a list of configuration commands for WMT700, see Vaisala WINDCAP® Ultrasonic Wind Sensor Series WMT700 User's Guide.

WA — Fetch Averaged Wind Speed and Direction

This command requests the averaged wind speed and direction message with peak winds.

```
WA <CR><LF>
```

The response to the **WA** command consists of the averaged wind speed and direction data, peak wind speed, and associated direction. The average wind speed is a scalar running average of the fundamental 1-second interval wind speed measurement made by WMT700. For a description of the data message, see section WS425 F/G ASOS Data Message on page 48.

You can set the wind averaging time and gust time with the **wndAvg** and **wndGustTime** parameters. Set the **wndVector** parameter to **0** to use scalar averaging.

The command also fetches the WMT700 status, the averaging time for average and peak wind speed and wind direction, and signal quality.

WS — Fetch Internal Diagnostics Information

This command requests the verbose Built-In Test (BIT) results.

```
WS<CR><LF>
```

The command gives a textual run down of the results of all Built-In Tests (BITs). In every line, except the bad reading counter, the pass/fail

indication is given with the single character P or F. This is followed by the description of the measured parameter, which is followed by the actual measured value.

The Bad 1 second readings counter is a running total of the number of fundamental 1-second readings that the sensor flagged as bad. This number rolls over to zero after reaching the count value of 65535. It is initialized to zero on each power-up or any other activity that performs a re-initialization of the sensor. The time measurement quality indices are given for path numbers as follows:

- Path 0 is from south transducer to north transducer
- Path 1 is from north transducer to south transducer
- Path 2 is from north transducer to east transducer
- Path 3 is from east transducer to north transducer
- Path 4 is from east transducer to south transducer
- Path 5 is from south transducer to east transducer

A listing for the command response is given below with representative values.

```
<CR><LF>
P Heater voltage 22.3 Volts <CR><LF>
P Array heater resistance 4.9 Ohms <CR><LF>
P Heaters off voltage 0.1 Volts <CR><LF>
P Incoming supply voltage 12.2 Volts <CR><LF>
P 5.0 volt supply 5.05 Volts <CR><LF>
P 10 volt supply 10.2 Volts CR LF
- Bad 1 second reading counter 0 <CR><LF>
P Path 0 signal quality index 99 <CR><LF>
P Path 1 signal quality index 99 <CR><LF>
P Path 2 signal quality index 99 <CR><LF>
P Path 3 signal quality index 99 <CR><LF>
P Path 4 signal quality index 99 <CR><LF>
P Path 5 signal quality index 99 <CR><LF>
```

The test limits for the various tests are as listed below:

- Heater voltage good in range 18.0 to 26.0 V
- Array heater resistance good in range 4.0 to 6.0 Ω
- Heaters off voltage good if below 0.5 V
- Incoming supply voltage good in range 10.5 to 13.5 V
- 5.0 V supply good in range 4.5 to 5.5 V
- 10 V supply good in range 9.0 to 11.0 V
- Signal Quality Index good above 50

WS425 F/G ASOS Data Message

WMT700 responds to the **WA** command with a data message described in Table 13 below.

Table 13 WS425 F/G ASOS Data Message

Byte	Description
1	Start of text
2	Sensor ID
3	Command identifier
4	Sensor status: P = Pass F = Fail H = Heater failure For further information, refer to notes 1 and 2.
5-7	Averaged wind direction (degrees)
8-10	Wind direction (degrees) @ peak wind speed
11-12	Averaging time for wind speed and direction
13-14	Averaging time for peak wind speed and direction (seconds)
15-19	Averaged wind speed
20-24	Peak wind speed since last WA command
25	Wind speed unit: M = miles per hour K = knots L = kilometers per hour T = meters per second
26-27	Signal quality. For further information, refer to note 3.
28-29	Hex checksum. For further information, refer to note 4.
30	End of text
31	Carriage return
32	Line feed

Notes:

1. The sensor status (byte 4) indicates the following:
   - P (Pass) indicates that all diagnostic tests have passed and WMT700 is functioning normally.
   - F (Fail) indicates that one or more of the diagnostic tests have failed. You can then request diagnostics and extended tests (WS) to further isolate the problem.
   - H (Heater failure) indicates that the wind reading is valid but one or more built-in heater diagnostic tests have failed.
2. When the status byte is F, the wind direction fields are set to 999 and the wind speed fields are set to 999.9 in the applicable sensor response messages.
3. The signal quality (bytes 26-27) is a numeric value from 0 to 99 representing the data quality of processed data samples during the averaging time.

For example, a value of 99 signifies that all data samples were determined to be valid and processed during the averaging time. If some samples were determined to be "missing", these samples were not processed and the reported signal quality is a proportional value less than 99.

4. Bytes 28-29 are the modulo 256 hexadecimal checksum of the ASCII values calculated for bytes from 2 to 27.

Example:

```
WAP2131870503012.6014.7K99xx
```

Interpretation of the example message:

- Sensor ID: W
- Command identifier: A
- Sensor status: P = pass
- Averaged wind direction (degrees): 213
- Wind direction (degrees) @ peak wind speed: 187
- Averaging time for wind speed and direction: 05
- Averaging time for peak wind speed and direction (seconds): 03
- Averaged wind speed: 012.6
- Peak wind speed since last WA command: 014.7
- Wind speed units: K = knots
- Signal quality: 99
- Hex checksum (refer to note 4): xx

WS425 A/B NMEA Standard Profile

When the WS425 A/B NMEA Standard profile is configured, WMT700 sends messages based on the configured automatic message interval. There are no operating commands available for the user.

Configurable Parameters

Table 14 on page 50 lists the configurable parameters and their allowed and default values for the WS425 A/B NMEA Standard profile.

Table 14 Configurable Parameters for WS425 A/B NMEA Standard Profile

Parameter	Default Value	Profile-specific Allowed Values	Description
address	1	String with 1 character	Address for WMT700.
autoInt	1	0.25 ... 1000 Resolution: 0.25	Automatic message interval in seconds. Do not select a message interval that is shorter than the time it takes to send a data message.
autoPort	1	1 = COM1 port 2 = COM2 port	Serial port to which WMT700 sends automatic data messages.
autoSend	0	19 = NMEA automatic data message	Automatic data message number. Selects the data message format for automatic messages.
com1_protocol com2_protocol (depending on the port used for operating WMT700)	0	4 = WS425 A/B NMEA Standard	Profile for serial ports COM1 and COM2.
wndAvg	1	0.25 … 3600 Resolution: 0.25	Averaging time for wind measurement in seconds.
wndOrientation	0	0 = array facing up 1 = array facing down	Orientation of the array of WMT700.
wndUnit	0	0 = meters per second 1 = miles per hour 2 = kilometers per hour 3 = knots	Wind speed unit.
wndVector	1	0 = scalar averaging	Wind averaging method.

To start continuous measurement, use the **START** command. You can stop the measurement with the **STOP** command. For instructions, refer to Vaisala WINDCAP® Ultrasonic Wind Sensor Series WMT700 User's Guide.

WS425 A/B NMEA Standard Data Message

The standard variable length, comma-separated, MWV wind message is defined by NMEA 0183 V2.20 as follows:

```
$WIMWV,<dir>,<ref>,<spd>,<uni>,<sta>*<chk><CR><LF>
```

where

$WIMWV = Fixed text
<dir> = Wind angle: 0 to 359 degrees

where

<ref>	=	Reference: R = relative T = true
<spd>	=	Wind speed
<uni>	=	Wind speed unit: K = kilometers per hour M = meters per second N = knots
<sta>	=	Status: A = data valid V = invalid data
*	=	Fixed text
<chk>	=	Checksum (8-bit XOR, excluding $ and *)
<CR>	=	Carriage return code, ASCII 0DH
<LF>	=	Line feed code, ASCII 0AH

NOTE When the NMEA Standard profile is selected, the **autoInt** parameter must have a non-zero value since no polling command is defined for this profile.

Missing Readings

If data is missing due to a measurement problem, the NMEA messages show "V" in the status field. WMT700 reports 999 for wind direction and 999.9 for wind speed.

WS425 NMEA Extended Profile (v. 0183)

When the WS425 A/B NMEA Extended profile is selected, you can set WMT700 to send messages based on the configured automatic message interval or poll data using the **$WIP** command.

Configurable Parameters

Table 15 on page 52 lists the configurable parameters and their allowed and default values for the WS425 A/B NMEA Extended profile.

Table 15 Configurable Parameters for WS425 A/B NMEA Extended Profile

Parameter	Default Value	Profile-specific Allowed Values	Description
address	1	String with 1 character	Address for WMT700.
autoInt	1	0.25 ... 1000 Resolution: 0.25	Automatic message interval in seconds. Do not select a message interval that is shorter than the time it takes to send a data message.
autoPort	1	1=COM1 port 2=COM2 port	Serial port to which WMT700 sends automatic data messages.
autoSend	0	0 = automatic messages disabled 19 = NMEA automatic data message	Automatic data message number. Selects the data message format for automatic messages.
com1_protocol com2_protocol (depending on the port used for operating WMT700)	0	5 = WS425 A/B NMEA Extended	Profile for serial ports COM1 and COM2.
wndAvg	1	0.25 … 3600 Resolution: 0.25	Averaging time for wind measurement in seconds.
wndOrientation	0	0 = array facing up 1 = array facing down	Orientation of the array of WMT700.
wndUnit	0	0 = meters per second 1 = miles per hour 2 = kilometers per hour 3 = knots	Wind speed unit.
wndVector	1	0 = scalar averaging	Wind averaging method.

To start continuous measurement, use the **START** command. You can stop the measurement with the **STOP** command. For instructions, refer to Vaisala WINDCAP® Ultrasonic Wind Sensor Series WMT700 User's Guide.

WS425 A/B NMEA Extended Commands

This command polls data from WMT700.

```
$WIP<id>Q,*<chk><CR><LF>
```

where

$WIP	=	Fixed text
<id>	=	Data ID; A … Z
Q	=	Fixed text
*	=	Fixed text
<chk>	=	Checksum (8-bit XOR, excluding $ and *)
<CR>	=	Carriage return code, ASCII 0DH
<LF>	=	Line feed code, ASCII 0AH

Table 16 Checksum Table

ID Character <id>	Checksum <chk>	Polling String
A	72	$WIPAQ,*72<CR><LF>
B	71	$WIPBQ,*71<CR><LF>
C	70	$WIPCQ,*70<CR><LF>
D	77	$WIPDQ,*77<CR><LF>
E	76	$WIPEQ,*76<CR><LF>
F	75	$WIPFQ,*75<CR><LF>
G	74	$WIPGQ,*74<CR><LF>
H	7B	$WIPHQ,*7B<CR><LF>
I	7A	$WIPIQ,*7A<CR><LF>
J	79	$WIPJQ,*79<CR><LF>
K	78	$WIPKQ,*78<CR><LF>
L	7F	$WIPLQ,*7F<CR><LF>
M	7E	$WIPMQ,*7E<CR><LF>
N	7D	$WIPNQ,*7D<CR><LF>
O	7C	$WIPOQ,*7C<CR><LF>

NOTE To use WMT700 with the NMEA Extended profile, either set the **autoSend** parameter to **0** to enable polling or define a fixed output interval with the **autoInt** parameter. If you are using automatic messages, the value for the **autoSend** parameter must be set to **19**.

WS425 A/B NMEA Extended Data Message

WS425 A/B NMEA Extended data message is as follows:

```
$P<id>MWV,<dir>,<ref>,<spd>,<uni>,<sta>*<chk><CR><LF>
```

where		
$P	=	Fixed text
<id>	=	Data ID; A … Z
MWV	=	Fixed text
<dir>	=	Wind angle: 0 to 359 degrees
<ref>	=	Reference: R = relative T = true
<spd>	=	Wind speed
<uni>	=	Wind speed unit: K = kilometers per hour M = meters per second N = knots
<sta>	=	Status: A = valid data V = invalid data
*	=	Fixed text
<chk>	=	Checksum (8-bit XOR, excluding $ and *)
<CR>	=	Carriage return code, ASCII 0DH
<LF>	=	Line feed code, ASCII 0AH

WS425 A/B ASCII Profile

NOTE In Vaisala WINDCAP® Ultrasonic Wind Sensor WS425 User's Guide, this profile was called the Handar mode.

Configurable Parameters

Table 17 below lists the configurable parameters and their allowed and default values for the WS425 A/B ASCII Profile.

Table 17 Configurable Parameters for WS425 A/B ASCII Profile

Parameter	Default Value	Profile-specific Allowed Values	Description
autoInt	1	0.25 ... 1000 Resolution: 0.25	Automatic message interval in seconds. Do not select a message interval that is shorter than the time it takes to send a data message.
autoPort	1	1=COM1 port 2=COM2 port	Serial port to which WMT700 sends automatic data messages.
autoSend	0	0 = automatic messages disabled	Automatic data message number. Selects the data message format for automatic messages.
com1_protocol com2_protocol (depending on the port used for operating WMT700)	0	3 = WS425 A/B ASCII	Profile for serial ports COM1 and COM2.
wndOrientation	0	0 = array facing up 1 = array facing down	Orientation of the array of WMT700.
wndUnit	0	0 = meters per second 1 = miles per hour 2 = kilometers per hour 3 = knots	Wind speed unit.
wndVector	1	0 = scalar averaging	Wind averaging method.

To start continuous measurement, use the **START** command. You can stop the measurement with the **STOP** command. For instructions, refer to Vaisala WINDCAP® Ultrasonic Wind Sensor Series WMT700 User's Guide.

WS425 A/B ASCII Commands

Table 18 below lists the available commands for operating WMT700 with the WS425 A/B ASCII profile.

Table 18 List of WS425 A/B ASCII Commands

Command	Description
I	Requests identification information for WMT700.
Wx	Starts measurement based on averaging time and fetches the data.

NOTE The following WS425 A/B ASCII command cannot be used with WMT700: Measurement Unit Change **Ux**

For a list of configuration commands for WMT700, see Vaisala WINDCAP® Ultrasonic Wind Sensor Series WMT700 User's Guide.

I — Identify Sensor

This command shows the vendor, model number and version information of WMT700.

```
I
```

Example of the command and response:

```
I

VAISALA WMT700 140
```

Wx — Start Measurement

This command starts wind measurement based on averaging time and fetches the data automatically when the measurement has finished. You must specify the averaging time in the command.

Averaging time supplied in the command (x) sets the averaging time for WMT700, as if it was set with the **S** command. When you change the averaging time, it applies to the next new wind value.

```
Wx
```

where

x = Time for averaging wind speed and wind direction. The range is from 1 to 9.

WMT700 responds to the **Wx** command with a 19-character fixed-length data message. For more information, see Table 19 below.

Table 19 WS425 A/B ASCII Data Message

Character	Description
1	┐ 02H (<STX>, start of transmission)
2	W
3	Averaging in seconds.
4	Status: P = pass F = fail
5	Wind direction (most significant digit)
6	Wind direction (middle digit)
7	Wind direction (least significant digit)
8	Wind speed (most significant digit)
9	Wind speed (next digit)
10	Wind speed (next digit)
11	Wind speed (least significant digit)
12	. (dot character)
13	Wind speed (tenth digit)
14	Wind speed unit: M = miles per hour K= knots L = kilometers per hour T = meters per second
15	Checksum (most significant digit). For more information, see the note below.
16	Checksum (least significant digit)
17	└ 03H (<ETX>, end of transmission)
18	CR (carriage return)
19	LF (line feed)

NOTE The checksum is calculated from the characters from position 2 to 14. The accumulator initializes at 0 with the addition of the byte value. The checksum has a range of 0H … FFH.

Example of the command and response:

```
W5

┐W5P1200013.2TDE└
```

Interpretation of the example message:

- ┌ 02H (<STX>, start of transmission)
- Sensor ID: W
- Averaging in seconds: 5
- Sensor status: P = pass
- Wind direction: 120
- Wind speed: 0013
- . (dot character)
- Wind speed unit: T = meters per second
- Checksum (most significant digit): D
- Checksum (least significant digit): E
- └ 03H (<ETX>, end of transmission)

Missing Readings

If data is missing due to a measurement problem, the WS425 A/B ASCII message reports 999.9 for wind speed.

WS425 A/B WAT11 Profile

Configurable Parameters

Table 20 below lists the configurable parameters and their allowed and default values for the WS425 A/B WAT11 profile.

Table 20 Configurable Parameters for WS425 A/B WAT11 Profile

Parameter	Default Value	Profile-specific Allowed Values	Description
com1_protocol com2_protocol (depending on the port used for operating WMT700)	0	6 = WS425 A/B WAT11	Profile for serial ports COM1 and COM2.

To start continuous measurement, use the **START** command. You can stop the measurement with the **STOP** command. For instructions, refer to Vaisala WINDCAP® Ultrasonic Wind Sensor Series WMT700 User's Guide.

WS425 A/B WAT11 Commands

When the WS425 A/B WAT11 profile is selected, you can poll data using the following command:

```
<esc><id>
```

where

<esc> = Escape character ASCII 27H
<id> = The WMT700 ID, for example, A

The response is the following:

```
<stx><id><spd><dir>
```

where

<stx> = Start of text character (1 digit)
<id> = The WMT700 identification character, for example, A (one digit).
<spd> = Wind speed (in meters per second) multiplied by 10. For example, 045 is 4.5 meters per second (three digits).
<dir> = Wind direction with two octal numbers for 6-bit binary data, for example, 73 corresponds to (**7***8+**3**)/64*360 = 332 degrees.

Missing Readings

The WS425 A/B WAT11 message reports missing data as slashes (/////).

SDI-12 Profile (v 1.3)

SDI-12 is a standard for interfacing data recorders with microprocessor-based sensors. The name stands for serial/digital interface at 1200 baud.

The SDI-12 Support Group is an association of companies that produce and use SDI-12 products with the purpose of reviewing requests to enhance, clarify, or modify the SDI-12 architecture and that votes on proposed changes to SDI-12.

For the complete SDI-12 standard text and information on the SDI-12 Support Group, refer to the SDI-12 web-site at the following address: http://www.sdi-12.org.

NOTE SDI-12 sub modes A and B are not supported by WMT700.

NOTE When establishing the terminal connection to WMT700, set the following communication settings for the SDI-12 profile:

Bits per second: 1200

Data bits: 7

Parity: 1

Stop bits: 1

Flow Control: None

Configurable Parameters

Table 21 below lists the configurable parameters and their allowed and default values for the SDI-12 profile.

Table 21 Configurable Parameters for SDI-12 Profile

Parameter	Default Value	Profile-specific Allowed Values	Description
address	1	1, 2, 3, 4, 5, 6, 7, 8, 9	Address for WMT700.
autoPort	1	2 = COM2 port	Serial port to which WMT700 sends automatic data messages.
autoSend	0	0 = automatic messages disabled	Automatic data message number. Selects the data message format for automatic messages.
com2_baud	4	1 = 1200	Baud rate for serial port COM2. Changes take effect only after reset or the **RESET** command. Note that low bit rate can affect measurement timing, if WMT700 cannot send the data message before new measurement starts.
com2_data	8	7 = 7 data bits	Data bits for serial port COM2. Changes take effect only after reset or the **RESET** command.
com2_interf	0	2 = SDI-12	Interface for serial port COM2. Changes take effect only after reset or the **RESET** command.
com2_parity	0	1 = even	Parity for serial port COM2. Changes take effect only after reset or the **RESET** command.
com2_protocol	0	1 = SDI-12	Profile for serial port COM2.
com2_stop	1	1 = 1 bit	Stop bits for serial port COM2. Changes take effect only after reset or the **RESET** command.
wndAvg	1	0.25 … 3600 Resolution: 0.25	Averaging time for wind measurement in seconds.
wndOrientation	0	0 = array facing up 1 = array facing down	Orientation of the array of WMT700.
wndUnit	0	0 = meters per second 1 = miles per hour 2 = kilometers per hour 3 = knots	Wind speed unit.
wndVector	1	0 = scalar averaging	Wind averaging method.

To start continuous measurement, use the **START** command. You can stop the measurement with the **STOP** command. For instructions, refer to Vaisala WINDCAP® Ultrasonic Wind Sensor Series WMT700 User's Guide.

SDI-12 Commands

Table 22 below lists the available commands for operating WMT700 with SDI-12 profile.

NOTE You can only use COM2 serial port for sending commands and receiving data messages with the SDI-12 profile.

Table 22 List of SDI-12 Commands

Command	Description
?!	Queries WMT700 for its address.
a!	Ensures that WMT700 is responding.
aI!	Queries WMT700 for its SDI-12 compatibility level, model number, and firmware version number.
aAb!	Changes WMT700 address.
aC!	Starts concurrent measurement.
aCC!	Starts concurrent measurement with CRC calculation.
aD0!	Fetches instant data from WMT700.
aM!	Starts measurement.
aMC!	Starts measurement with CRC calculation.
aV!	Starts verification.

where

a = The single-digit WMT700 address that corresponds to the first character of the **address** value.
! = Terminates the command.

NOTE The following SDI-12 commands cannot be used with WMT700: Measurement Unit Change Command **aXUx!,** Heater Control Command **aXHx!**, Check Current Sub mode **aX?!**, Place Sensor in Sub mode B Command **aXQx;c.c;n;yyyy!**, Reset the Sensor to Sub mode A Command **aXS!**, Check Current Measurement Unit Command **aX*!, aR0!** Continuous Measurement.

For a list of configuration commands for WMT700, see Vaisala WINDCAP® Ultrasonic Wind Sensor Series WMT700 User's Guide.

?! — Address Query

This command queries for the WMT700 address.

When you use a question mark (?) as the address character with the **a!** command, WMT700 responds as if it was being addressed on the SDI-12 bus. Regardless of its address, WMT700 responds to the command, which allows you to determine the address for the wind sensor.

NOTE	If more than one WMT700 is connected to the bus, they all respond, causing a bus contention.

```
?!
```

where

?	=	Wildcard
!	=	Terminates the command.

The response is the following:

```
a<CR><LF>
```

where

a	=	The single-digit WMT700 address that corresponds to the first character of the **address** value.
<CR><LF>	=	Terminates the response.

a! — Acknowledge Active

This command ensures that WMT700 is responding to a data recorder or another SDI-12 device. It asks the WMT700 to acknowledge its presence on the SDI-12 bus.

```
a!
```

where

a	=	The single-digit WMT700 address that corresponds to the first character of the **address** value.
!	=	Terminates the command.

The response is the following:

```
a<CR><LF>
```

where

a	=	The single-digit WMT700 address that corresponds to the first character of the **address** value.
<CR><LF>	=	Terminates the response.

Example of the command and response:

```
1!

1<CR><LF>
```

aAb! — Change Address

This command changes the WMT700 address. After WMT700 has received this command and sent a response, the sensor does not respond to any other command for one second. This gives WMT700 time to write the new address to the non-volatile memory.

NOTE	You can also change the WMT700 address by entering configuration mode and changing the **address** parameter.

```
aAb!
```

where

a	=	The current single-digit WMT700 address that corresponds to the first character of the **address** value.
A	=	The change address command.
b	=	The new address.
!	=	Terminates the command.

The response is the following:

```
b<CR><LF>
```

where

b	=	The new single-digit WMT700 address (or the original address if WMT700 is unable to change the address).
<CR><LF>	=	Terminates the response.

aC! — Start Concurrent Measurement

This command starts concurrent measurement. WMT700 does not return measurement data after this command. It sends a response that indicates when the measurement result can be retrieved using the **aD0!** command and the number of parameters.

```
aC!
```

where

a	=	The single-digit WMT700 address that corresponds to the first character of the **address** value.
C	=	The start concurrent measurement command.
!	=	Terminates the command.

The response is the following:

```
atttnn<CR><LF>
```

where

a	=	The single-digit WMT700 address that corresponds to the first character of the **address** value.
ttt	=	The period of time, in seconds, after which WMT700 has the measurement ready.
nn	=	The number of measurement values WMT700 calculates and returns as a response to one or more subsequent **aD0!** commands.
<CR><LF>	=	Terminates the response.

Example of the command and response:

```
1C!
```

```
100205<CR><LF>
```

Interpretation of the example message:

- Time after which the measurement is ready: 2 seconds
- Number of returned measurement values: 5

To fetch the measurement results, use the **aD0!** command.

aD0! — Send Data

This command fetches instant data from WMT700. **aD0!** must be preceded by a **C!**, **M!**, or **V!** command.. WMT700 responds by sending measurement data (after **C!** or **M!**) or verification data (after **V!**).

In a SDI-12 system compliant with the standard, if the expected number of measurements is not returned in response to an **aD0!** command, a data recorder issues **D1!**, **D2!**, and so on, until all measurement values are received. The expected number of measurements is included in the message that WMT700 sends in response to an **aC!**, **aM!** or **aV!** command. Multiple data requests are not needed with WMT700, since all return values fit easily into one response string.

```
aD0!
```

where

a	=	The single-digit WMT700 address that corresponds to the first character of the **address** value.
D0	=	The send data command.
!	=	Terminates the command.

For a description of the data messages, see section SDI-12 Data Messages on page 70.

aI! — Send Identification

This command queries WMT700 for its SDI-12 compatibility level, model number, and firmware version number.

```
aI!
```

where

a	=	The single-digit WMT700 address that corresponds to the first character of the **address** value.
I	=	The send identification command.
!	=	Terminates the command.

The response is the following:

```
allccccccccmmmmmmvvvxxx . . . xxx<CR><LF>
```

where

a	=	The single-digit WMT700 address that corresponds to the first character of the **address** value.
11	=	The SDI-12 version number, indicating SDI-12 version compatibility; for example, version 1.1 is encoded as 11.
cccccccc	=	An 8-character vendor identification Vaisala_
mmmmmm	=	6 characters specifying the model number of WMT700.
vvv	=	3 characters specifying the firmware version 604.
xxx ... xxx	=	An optional field, up to 13 characters, used for a serial number or other specific WMT700 information that is not relevant for operation of the data recorder (not used).
<CR><LF>	=	Terminates the response.

aM! — Start Measurement

This command starts measurement. WMT700 does not return measurement data after this command. It sends a response that indicates when the measurement result can be retrieved using the **aD0!** command and the number of parameters.

```
aM!
```

where

a	=	The single-digit WMT700 address that corresponds to the first character of the **address** value.
M	=	The start measurement command.
!	=	Terminates the command.

The response is the following:

```
atttn<CR><LF>
```

where

a	=	The single-digit WMT700 address that corresponds to the first character of the **address** value.
ttt	=	The period of time, in seconds, after which WMT700 has the measurement ready.
n	=	The number of measurement values WMT700 calculates and returns as a response to one or more subsequent **aD0!** commands.
<CR><LF>	=	Terminates the response.

Example of the command and response:

```
1M!
```

```
10025<CR><LF>
```

Interpretation of the example message:

- Time after which the measurement is ready: 2 second
- Number of returned measurement values: 5

To fetch the measurement results, use the **aD0!** command.

aV! — Start Verification

This command starts verification. However, WMT700 does not return verification data directly after this command. It sends a response that specifies when the verification results can be retrieved using the **aD0!** command and the number of parameters. The WMT700 verification data includes a watchdog count, sensor measurement unit settings, and the current SDI mode setting.

The command is the following:

```
aV!
```

where

a = The single-digit WMT700 address that corresponds to the first character of the **address** value.
V = The start verification command.
! = Terminates the command.

The response is the following:

```
atttn<CR><LF>
```

where

a	=	The single-digit WMT700 address that corresponds to the first character of the **address** value.
ttt	=	The period of time, in seconds, after which WMT700 has the verification data ready.
n	=	The number of verification data fields that will be returned.
<CR><LF>	=	Terminates the response.

Example of the command and response:

```
1V!

10014<CR><LF>
```

Interpretation of the example message:

- Time when the measurement is ready: 1 second
- Number of returned measurement values: 4

To fetch the measurement results, use the **aD0!** command.

SDI-12 Data Messages

When SDI-12 profile is selected, the data message sent by WMT700 depends on the command that you use before fetching the data with **aD0!** command.

WS425 A/B SDI-12 Message for C and M Command

When you have given the commands **aC!** or **aM!** followed by **aD0!**, the response is the following:

```
a<WS><WD><x><y><s><CR><LF>
```

where

a	=	The single-digit WMT700 address that corresponds to the first character of the **address** value.
<WS>	=	Polar wind speed in selected units Format: +(ss)s.s
<WD>	=	Polar wind direction in degrees Format: +(dd)d.d
<x>	=	x component of wind speed in selected units Format: ±(ss)s.s
<y>	=	y component of wind speed in selected units Format: ±(ss)s.s
<s>	=	Static speed of sound in miles per hour Format: ±(ss)s.s
<CR><LF>	=	Terminates the response.

The above are measurement data fields.

Missing Readings

If data is missing due to a measurement problem (for example, blocked paths between transducers), the measurement data is replaced with 999.9.

Example of the command and response when data is missing:

```
7D0!

7+999.9+999.9+999.9+999.9+999.9 <CR><LF>
```

WS425 A/B SDI-12 Message for V Command

When you have given the commands **aV!** and **aD0!**, the response is the following:

```
a<watchdog><WS_unit><SDI-mode><spare><CR><LF>
```

where

a	=	The single-digit WMT700 address that corresponds to the first character of the **address** value.
<watchdog>	=	The number of times the watchdog has triggered. Ideally should be zero. Format: +(c)c
<WS_unit>		Wind speed unit. The options are: +0 = mph +1 = kt +2 = km/h +3 = m/s
<SDI-mode>		Current sub mode setting. The options are: +0 = SDI-12 sub mode A +1 = SDI-12 sub mode B
<spare>		1 digit for factory use, format: +c
<CR><LF>		Terminates the response.

The above are verification data fields.

Requesting Cyclic Redundancy Check

Error detection capability can be enhanced by using **aCC!** or **aMC!** command to start the measurement. These commands have the same function and send the same response as commands **aC!** and **aM!** respectively. The difference is, that Cyclic Redundancy Check will be appended to the data returned by **aD0!** command.

The 16 bit Cyclic Redundancy Check value is appended to the response of **aD0!** command before the <CR><LF>. It is encoded as three ASCII characters using the following algorithm:

```
1st character=0x40 OR (CRC shifted right 12 bits)
2nd character=0x40 OR ((CRC shifted right 6 bits) AND 0x3F)
3rd character=0x40 OR (CRC AND 0x3F)
```

Example of the command and response:

```
1MC!

10025<CR><LF>

1D0!

1+2.7+85.2-0.2-2.7+770.5CAH<CR><LF>
```

CHAPTER 6
TROUBLESHOOTING

This chapter describes common problems, their probable causes and remedies, and provides contact information for technical support.

Problem Situations

Table 23 below lists some problems situations that can occur during or after retrofit installation. For general troubleshooting instructions, refer to Vaisala WINDCAP® Ultrasonic Wind Sensor Series WMT700 User's Guide.

Table 23 Some Problem Situations and Their Remedies

Problem	Probable Cause	Remedy
Retrofit installation of WMT700 is not possible.	You do not have the correct mounting kit for the retrofit installation.	Check that you are using the FIX30 or FIX60 mounting kit and the correct mounting adapter. If you do not have the correct mounting kit, contact Vaisala technical support.
WMT700 does not work properly after retrofit installation.	Incorrect cables were used in the retrofit installation.	Check that you have used cables listed in Check List for Connection Cables on page 24. If you do not have the correct cables, contact Vaisala technical support.
Connection to WMT700 is lost.	The power supply is not sufficient, especially if you are using a heated version of WMT700.	Check that the power supply matches the requirements in section Powering on page 30.

Technical Support

For technical questions, contact the Vaisala technical support by e-mail at helpdesk@vaisala.com. Provide at least the following supporting information:

- Name and model of the product in question
- Serial number of the product
- Name and location of the installation site
- Name and contact information of a technically competent person who can provide further information on the problem.

Product Returns

If the product must be returned for service, see www.vaisala.com/services/return.html.

For contact information of Vaisala Service Centers, see www.vaisala.com/services/servicecenters.html.

APPENDIX A
COMPLETE COMMAND SET FOR WMT700

Table 24 below lists all the commands available for WMT700.

Table 24 Command Set for All Profiles Supported by WMT700

Configuration Mode/ Measurement Mode and Profile	Command	Description	Further Information[1]
Configuration mode	?	Displays a list of configuration commands.	User's Guide
Configuration mode	BAUD	Changes or displays serial port settings.	User's Guide
Configuration mode	CLEARERR	Resets error counters.	User's Guide
Configuration mode	CLOSE	Switches the serial port to measurement mode.	User's Guide
Configuration mode	ERRORS	Displays error values and counts	User's Guide
Configuration mode	G	Displays either all or specified parameters.	User's Guide
Configuration mode	H	Displays list of data messages and available values for measurement unit, profile, baud rate, interface, and analog output mode.	User's Guide
Configuration mode	MEAS	Starts wind measurement based on the user-configurable averaging time. WMT700 does not send data messages automatically.	User's Guide
Configuration mode	POLL	Tests data polling.	User's Guide
Configuration mode	RESET	Resets WMT700.	User's Guide
Configuration mode	S	Changes selected parameters or defines new data messages.	User's Guide
Configuration mode	START	Starts continuous measurement.	User's Guide
Configuration mode	STOP	Stops continuous measurement.	User's Guide
Configuration mode	VERSION	Displays the software version.	User's Guide
Configuration mode	WIND_GET	Fetches wind calibration information.	User's Guide
Measurement Mode WMT700 profile	MEAS	Starts wind measurement. The duration of the measurement is based on the user-configurable averaging time.	User's Guide

[1] In this table, Technical Reference refers to this manual, while User's Guide refers to Vaisala WINDCAP® Ultrasonic Wind Sensor Series WMT700 User's Guide.

Configuration Mode/ Measurement Mode and Profile	Command	Description	Further Information[1]
Measurement mode WMT700 profile	OPEN	Switches the serial port to configuration mode.	User's Guide
Measurement mode WMT700 profile	POLL	Fetches data from WMT700.	User's Guide
Measurement mode WMT700 profile	SLEEP	Switches WMT700 from normal operating mode to low-power mode.	User's Guide
Measurement Mode MES12 profile	@a M 12	Polls data from WMT700 in the MES12 data message format.	User's Guide
Measurement mode WS425 ASOS F/G profile	WA	Requests average wind speed and direction message.	Technical Reference
Measurement mode WS425 ASOS F/G profile	WS	Requests the verbose Built-In Test (BIT) results.	Technical Reference
Measurement mode WS425 A/B NMEA Extended profile	$WIP	Polls data from WMT700.	Technical Reference
Measurement mode WS425 A/B ASCII profile	I	Requests identification information for WMT700.	Technical Reference
Measurement mode WS425 A/B ASCII profile	Wx	Starts measurement based on averaging time and fetches the data.	Technical Reference
Measurement mode WS425 A/B WAT11 profile	<esc><id>	Polls data from WMT700.	Technical Reference
Measurement mode SDI-12 profile	?!	Queries WMT700 for its address.	Technical Reference
Measurement mode SDI-12 profile	a!	Ensures that WMT700 is responding.	Technical Reference
Measurement mode SDI-12 profile	aI!	Queries WMT700 for its SDI-12 compatibility level, model number, and firmware version number.	Technical Reference
Measurement mode SDI-12 profile	aAb!	Changes WMT700 address.	Technical Reference
Measurement mode SDI-12 profile	aC!	Starts concurrent measurement.	Technical Reference
Measurement mode SDI-12 profile	aCC!	Starts concurrent measurement. CRC is included in the response.	Technical Reference
Measurement mode SDI-12 profile	aD0!	Fetches instant data from WMT700.	Technical Reference
Measurement mode SDI-12 profile	aM!	Starts measurement.	Technical Reference
Measurement mode SDI-12 profile	aMC!	Starts measurement. CRC is included in the response.	Technical Reference
Measurement mode SDI-12 profile	aV!	Starts verification.	Technical Reference

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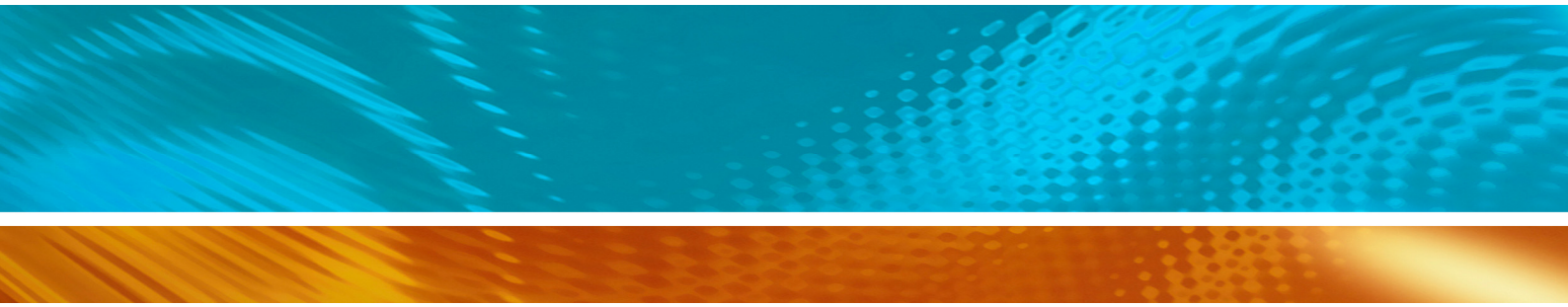

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